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Docket Number 50-346

License Number NPF-3

Serial Number 3045

May 25, 2004

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Request for Additional Information Regarding Root Cause Analysis Report (TAC No. MC1642)

Ladies and Gentlemen:

By letter dated March 4, 2004, the NRC staff issued a request for additional information concerning the Davis-Besse Nuclear Power Station Unit Number 1 (DBNPS) technical Root Cause Analysis Report, "Significant Degradation of the Reactor Pressure Vessel Head". This report was first submitted to the NRC by the FirstEnergy Nuclear Operating Company (FENOC) under letter Serial Number 1-1270, dated April 18, 2002, and Revision 1 of the report was later submitted under Serial Number 1-1289, dated September 23, 2002. The following provides FENOC's responses to the NRC's request for additional information.

Question 1:

The purpose of the vent line that runs from nozzle 14 to the steam generator number 2 upper primary hand hole is to vent non-condensible gases from the Davis Besse reactor pressure vessel (RPV) head during a loss of coolant accident. The head vent configuration at Davis Besse is unique from other Babcock and Wilcox (B&W) designs in that reactor coolant flows continuously through it during power operations. Given the proximity of the cracked nozzles in the old RPV head to the vent line nozzle, a phenomenon may exist wherein the continuous flow through the vent line impacts the potential for cracking of nearby nozzles. This same phenomenon, if real, could impact the cracking assumptions for the new RPV head.

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Confirm whether or not you considered this potential phenomenon in the April 2002 root cause analysis that was performed as a result of the degradation of the old RPV head. If an evaluation was performed, provide the results of the technical analysis that would demonstrate that the phenomenon either did or did not impact cracking in adjacent nozzles. If this potential phenomenon was not considered, provide the technical basis for discounting it. If it was not discounted, but it was never considered, provide a technical basis for why it will or will not play a role in the operation of the new RPV head. If your analysis results show that there is a potential impact on the new RPV head penetrations, discuss the actions that would be taken to ensure the integrity of the head penetrations. Consider whether an update to your root cause analysis report is needed.

Response:

Locations of Cracked Nozzles

The potential effect of the reactor vessel continuous vent line on increasing the likelihood of nozzle cracking was discussed in Section 3, Data Analysis, of the technical Root Cause Analysis Report (page 12 of revision 0, dated April 15, 2002, and page 15 of revision 1, dated August 27, 2002). Its effect was considered along with other differences of the DBNPS nozzles, such as operating temperature, counterbores, material susceptibility to primary water stress corrosion cracking (PWSCC), and range of interference fits. The potential effect of the reactor vessel continuous vent line was evaluated based on established facts of damage to other nozzles. Among these were:

1. Automated ultrasonic examinations of all 69 Control Rod Drive Mechanism nozzles were performed from beneath the Reactor Pressure Vessel (RPV) head. As reported on page 6 of the technical Root Cause Analysis Report, nozzles 1, 2, 3, and 5 all exhibited flaws. This meant that 4 of the 5 nozzles from Heat M3935 had flaws, and they were all clustered at the top of the head, not around the continuous vent line's nozzle 14 (see attached figure from the technical Root Cause Analysis Report). As discussed on page 16 of the technical Root Cause Analysis Report, Heat M3935 has exhibited a higher PWSCC susceptibility in the industry.

2. The only nozzle with flaws that was somewhat proximate to nozzle 14 itself was nozzle 2.

3. The only other nozzle with a confirmed flaw was nozzle 47, which is on the perimeter of the head, quite some distance from nozzle 14.

4. Overall, it was determined that the head temperatures were sufficiently high to support the initiation of cracks due to PWSCC.

Accordingly, the technical Root Cause Analysis Report concluded the effect of the continuous vent line on the nozzles was very small.

The new RPV head will be inspected in accordance with the requirements of NRC Order EA-03-009, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors, which will include inspections of nozzle 14 and its surrounding nozzles. The continuous vent line proximity "potential phenomenon" has been discounted (see items 1-4 above) as the cause of the nozzle cracking. Therefore, there are no actions to take regarding the continuous vent line with respect to the operation of the new RPV head nozzles.

Context of Head Temperature

Head temperature was a key consideration in the technical Root Cause Analysis Report, but primarily as a confirmatory fact in establishing that the extent of DBNPS nozzle cracking was consistent with metallurgical expectations of performance. In other words, the technical root cause team had to determine if the history of head temperature and time in service supported the other evidence that pointed to PWSCC as the initiator of the cracks and leaks that were found. The technical root cause team determined that head temperatures were sufficiently high to produce the extent of cracking found. If the head temperatures were later determined to be several degrees higher or lower, it would have no bearing on the conclusion that the temperature was clearly high enough for the damage to occur within the service time experienced. From a technical root cause analysis perspective, no further refinement of head temperature data or analysis was needed.

Need for Revision to the Technical Root Cause Analysis Report

The data analysis reported and evaluated in both the initial and revised technical Root Cause Analysis Reports continues to support the root cause determination of PWSCC as the cause of the degradation of the RPV head. Variation of the RPV head temperature from the reported average value would have no effect on the conclusions of the report. The potential for the continuous vent line to have caused the flaws in nozzles 1, 2, 3, 5, and 47 was considered during the technical root cause analysis. It was concluded that this potential was very small, as documented on page 15 of revision 1 to the report. Therefore, no revision to the technical Root Cause Analysis Report is necessary.

Question 2:

You used 605 °F for the time-at-temperature calculations for the old RPV head. This value is apparently an average of hot leg temperatures. Use of this temperature, given that you have hot leg resistance temperature detectors (RTDs) with higher temperature values, does not appear to result in a conservative effective degradation year (EDY) calculation.

A. Inform the staff as to which temperature value you will use in determining the EDY of your new RPV head, i.e., the average of hot leg temperatures or the highest hot leg temperature. If you do not plan to use the highest hot leg temperature, then respond to items B and C below.

B. Provide an explanation for the differences in temperature readings for the RTDs used in determining the average value used in the EDY calculation.

C. Provide a technical basis for not using the highest hot leg temperature measurement as input to the EDY calculation.

Response:

FENOC will use temperature data from the loop with the highest average hot leg temperature (using the narrow range instrumentation) to determine the EDY of the new RPV head. Because of differences in the configuration of the reactor coolant loops, Loop 1 hot leg temperature normally is slightly higher than Loop 2 hot leg temperature. FENOC also considered using temperature data from the reactor vessel continuous vent line. However, at the present time, the accuracy of this instrumentation is insufficient to be used to calculate EDY. FENOC will address the accuracy and potential future use of this instrumentation through the DBNPS corrective action program.

NRC Order EA-03-009, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors, provided the following instruction for the EDY calculation:

This calculation shall be performed with best estimate values for each parameter at the end of each operating cycle for the RPV head that will be in service during the subsequent operating cycle.

FENOC's perspective is that the "best estimate" required by Order EA-03-009 can best be determined by averaging[1] the valid temperature readings measured from the hot leg with the highest average temperature. Averaging of valid readings also reduces the impact of instrument uncertainty. Accordingly, using a single highest individual hot leg temperature measurement would be inappropriate, and less likely to reflect actual plant operating conditions. Although averaging will be used to determine the "best estimate", the input data will come from the loop with the highest average hot leg temperature.

If you have any questions or require further information, please contact Mr. Gregory A. Dunn, Manager – Regulatory Affairs, at (419) 321-8450.

Very truly yours,

MSH

[1] FENOC may average temperatures at the same point in time, but FENOC will not average different temperatures from different points in time. The exponential form of the EDY formula requires that different temperatures from different points in time be calculated independently. In addition, all temperature measurements will be from the hot leg with the highest average temperature, normally Loop 1.

Attachment A. Figure

Attachment B: Commitment List

cc: J. L. Caldwell, Regional Administrator, NRC Region III
J. B. Hopkins, DB-1 Senior NRC/NRR Project Manager
C. S. Thomas, DB-1 NRC Senior Resident Inspector
Utility Radiological Safety Board

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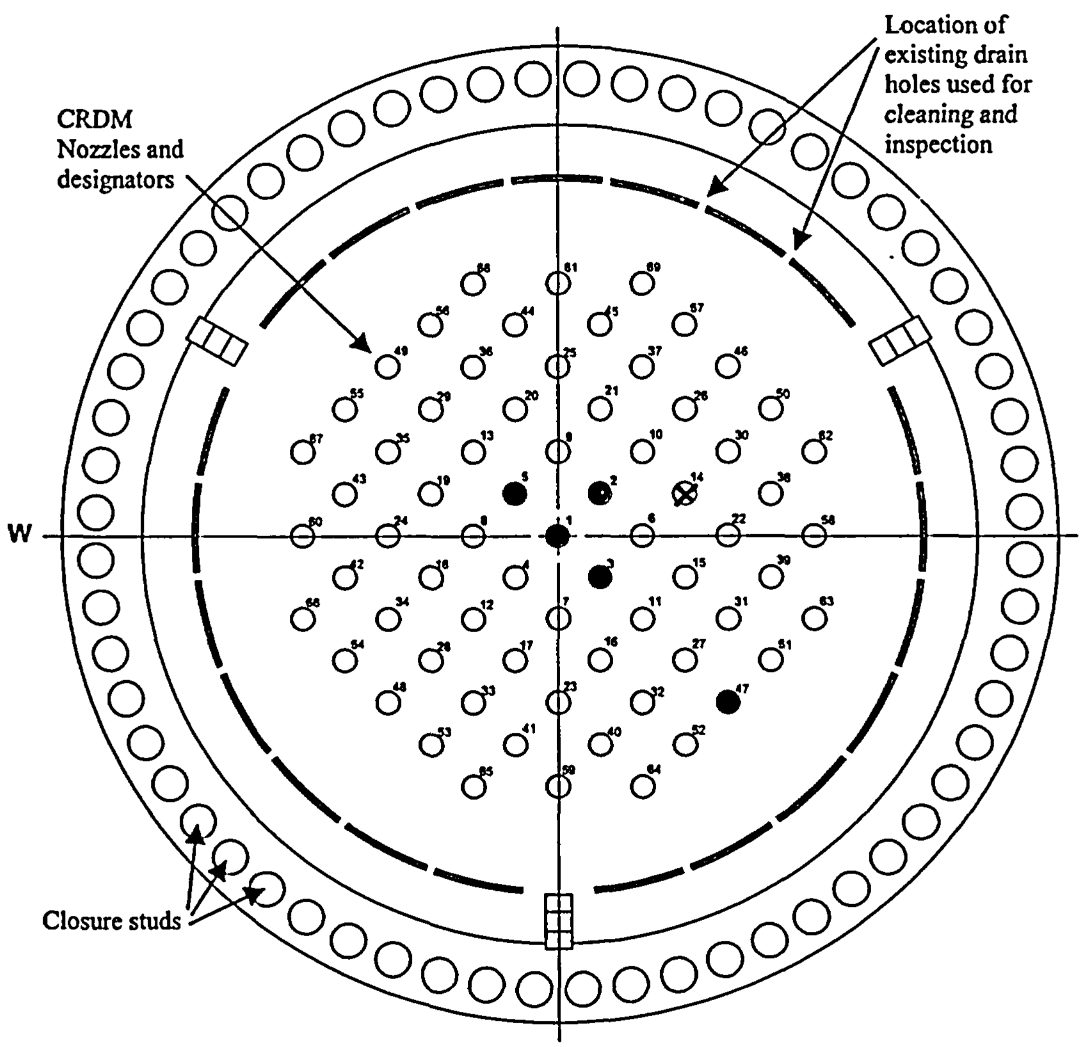
Attachment A

Davis-Besse Top of Reactor Head

Source: EPRI/DEI



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Attachment B

COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station, Unit Number 1, (DBNPS) in this document. Any other actions discussed in the submittal represent intended or planned actions by the DBNPS. They are described only for information and are not regulatory commitments. Please notify the Manager – Regulatory Affairs (419-321-8450) at the DBNPS of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
FENOC will use temperature data from the loop with the highest average hot leg temperature (using the narrow range instrumentation) to determine the EDY of the new RPV head.	Whenever calculating EDY for Order EA-03-009
FENOC will address the accuracy and potential future use of the continuous vent line temperature instrumentation through the DBNPS corrective action program.	As required by the corrective action program